The Nature and Use of Technology-Based Self-Regulated Learning Strategies Among EFL Students

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This study explored the nature and use of technology-based self-regulated learning (SRL) strategies among the Chinese university students. A total of 20 undergraduate students in mainland China were invited to participate in a focus group interview. The students reported using four types of technology-based SRL strategies including cognitive, meta-cognitive, social behavioral, and motivational regulation strategies. Among the strategies, technology-based vocabulary learning was reported to be a dominant strategy by the students. This study opens a new window to understanding how English as a foreign language (EFL) students utilize different strategies to learn English in technology-based learning context.

Keywords: self-regulated learning, technology-based SRL strategies, EFL students, language learning

Introduction

Self-regulated learning (SRL) has been recognized as an essential requirement for autonomous life-long learning (Kurbanoglu, 2003; Teng & Zhang, 2016). It has also been believed to be a significant variable in the field of second and foreign language education (e.g., Dornyei & Ryan, 2015; Oxford, 2013). A considerable bulk of research has revealed the critical role of SRL strategies in foreign language acquisition (e.g., An, Gan, & Wang, 2020; Lynch & Dembo, 2004; Teng & Zhang, 2016), and the great impact of individual difference factors on the use of SRL strategies (e.g., Daniela, 2015; Su, Zheng, Liang, & Tsai, 2018; Wang, Shannon, & Ross, 2013). For instance, Daniela (2015) found that SRL had powerful effects on students' learning performance. Su et al.'s (2018) study revealed that efficacious learners were more likely to employ SRL strategies, and learners with strong SRL skills were generally more self-efficacious. However, most previous research was conducted in traditional language learning contexts, although technology-enhanced language learning has boomed for decades of years.

Technology provides global language learners with diversified opportunities for language learning: online dictionaries and a variety of other language learning apps, easy access to native speakers and teachers, a large quantity of videos on language learning, and easy contact with language learning communities (Lai & Gu, 2011; Thorne, Black, & Sykes, 2009). The educational potentials of technology have been recognized by various researchers (e.g., Barnard et al., 2009; Lai & Gu, 2011; Lee, Yeung, & Cheung, 2019), and these potentials are expected to enhance learners' foreign language acquisition in terms of language proficiency and SRL strategies. Furthermore, existing empirical evidence consistently indicates that technology-based self-regulation is closely associated with students' academic achievement (e.g., An et al., 2021; Tseng, Liang, & Tsai, 2014; Winters,

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Greene, & Costich, 2008). However, the limited number of existing studies on technology-based self-regulated language learning strategies were either conducted with students using online learning platforms or students taking specific online courses, which excluded the significant impact of self-regulated use of various technological tools, such as mobile learning apps, mp3, and social interactive websites. Moreover, most of the existing studies examined SRL through quantitative methods and measures (e.g., An et al., 2021; Barnard et al., 2009; R. S. Jansen & J. Janssen, 2017), which did not attempt to figure out the reasons of students' specific technology-based SRL strategy use.

With the purpose of addressing these gaps, this study aims to explore the nature and use of SRL strategies employed by EFL university students in technology-based language learning context. This knowledge is particularly needed as learners' theoretical conceptions of how they initiate, plan, implement, and monitor their learning experiences in different learning contexts have practical implications for both teaching and learning (Zimmerman, 1986).

Literature Review

SRL refers to self-generated thoughts, feelings, and behaviors (Zimmerman, 2000). Originating from educational psychology, SRL has been approached from various theoretical perspectives, among which social cognitive perspective has gained increasing attention from researchers. In keeping with a social cognitive perspective of learning, Zimmerman (1989; 2003; 2000) has developed three models of SRL. The first model is the Triadic Analysis of SRL, involving the interactions of three levels in SRL: environment, behavior, and person (Zimmerman, 1989). Informed by Bandura's (1986) triadic formulation, this model holds that SRL is determined not only by personal processes, but influenced by environmental and behavioral events. The second model, known as Zimmerman's model, describes the cyclical phases of SRL, which explains the interrelation of metacognitive and motivational processes at the individual level. This model was organized in three phases: forethought, performance, and self-reflection. In the forethought phase, students analyze the tasks and set goals and plans. In the performance phase, learners exerted self-control strategies to cognitively engage themselves in the tasks and motivated themselves to complete the tasks. In the self-reflection phase, students self-evaluated their performance and made attributions about their success or failure. The third model was called "the Multi-Level model", describing the four stages (observation, emulation, self-control, and self-regulation) of how students acquire their self-regulatory competency (Zimmerman, 2000). At the observation stage, novices learn through observing proficient people use the skills that they want to master. At the emulation stage, the observers imitate the behaviors of those experienced individuals. For the self-control stage, the observers start to practice the modeled behavior independently. And for the self-regulation stage, the learners regulate their skills and goals across changing personal and environmental conditions. Therefore, SRL can be considered as an autonomous learning management process, in which learners utilize various strategies to plan, monitor, and reflect on their learning trajectory (Pintrich, 2000; Zimmerman, 1989).

It has been acknowledged that SRL strategies consist of four facets: cognition, metacognition, social behavior, and motivational regulation (Oxford, 2013; Pintrich & DeGroot, 1990; Zimmerman, 2011). Cognitive strategies include assembling, consolidating, elaborating, and transforming knowledge of the language and culture (Oxford, 2013). Metacognitive strategies aid the learners in focusing, planning, obtaining resources, organizing, coordinating, monitoring, and evaluating the construction of L2 knowledge (Oxford, 2013). Social behavioral strategies concern learners' attempt to construct environment, seek out information and social

assistance, and self-instruct during learning process (Zimmerman, 2013). Motivational regulation strategies have been described as individuals' actions to control, manipulate, and maintain their motivation for active engagement in the learning process (Erarslan & Seker, 2021). Current studies have also identified different SRL strategies pertaining to the four aspects (e.g., An et al., 2020; Pintrich & De Groot, 1990; Teng & Zhang, 2016).

Recent years, research on SRL strategies has been extended into technology-enhanced language learning environment, which has provided empirical evidence for the rich potential of technology-based learning contexts for fostering SRL (An et al., 2021; Lai & Gu, 2011; Wang et al., 2013) and the critical role of SRL in web-based learning environment (Barnard et al., 2009). As argued by Carneiro and his colleagues (2007), technology-based learning settings provide students with opportunities to foster SRL abilities. Moreover, students with SRL abilities can make full use of technology-enhanced learning contexts, thus enhancing learning outcomes (Hannafin & Hannafin, 2010). Empirical studies have provided evidence for the important role of SRL strategy use in technology-based/online learning environment. For example, An et al. (2021) found that technology-based SRL strategies significantly affected EFL learners' language learning achievement. Zhou and Wang's (2019) research revealed a strong positive correlation between the effort regulation and final grades of students in an online psychology course. While the prior studies explored students' use of SRL strategies in technology-based or online learning environment, little research had conducted to investigate the nature and use of technology-based SRL strategies in English as a foreign language (EFL) context.

Method

The intent of the study was to describe the nature and use of EFL students' technology-based SRL strategies. In accordance with the research problems and aims of the study, we adopted exploratory qualitative research design making use of group discussion in focus groups.

Participants

Altogether 20 Chinese EFL students (11 males and nine females) were invited to participate in the focus group interview. The participants were first-year and second-year undergraduate students from a variety of subject backgrounds such as Business, Accounting, and Hotel Management. At the time of data collection, all the students had received formal English education for over six years and experienced College Entrance Examination in mainland China. English is a compulsory course for first-year and second-year students in the university where English teachers and students meet for 3-4.5 hours per week in classrooms. All students in the university are required to pass CET-4 (College English Test—Band 4) before graduation.

Procedure

The interviews were conducted in the spring of 2024 in three focus groups consisting of five to eight participants. Each interview was started with an introduction of the interviewer as well as the purpose and procedures of the study. During the focus group interview course, we facilitated the participants to share their views and experiences in a relaxing environment. The length of the interviews ranged from 30 minutes to 45 minutes. The interviews were recorded by means of digital recorder. The interview questions were based on Zimmerman's model of SRL (Zimmerman, 2002). Altogether seven questions were developed to explore the nature and use of EFL students' technology-based SRL strategies.

Data Analysis

The data generated from focus group interviews were analyzed at both an individual level and group level.

NVivo 11 was used for the development, management, and organization of data, nodes, and categories. The coding process began with descriptive coding and advanced through open coding. Consequently, broad categories were developed.

Then, we initiated another round of coding emphasizing the whole rather than individual patterns. During the second round of data analysis, we focused on the patterns as they emerged from group discussions, and then organized them into broad categories. For example, as we analyzed individual responses to the question that inquired students' motivational regulation strategies, we classified their responses into three categories: learning, performance, and learning and performance-oriented goals. Then, the next step, the responses were examined in a group to see how these trends develop within a particular focus group discussion.

The interplay between the individual and group level data analyses is beneficial for us to identify the participants' technology-based SRL experiences and strategies, and to further investigate how EFL students formed, reflected, and justified their opinions.

Findings and Discussion

Nature of Technology-Based SRL Strategies

In this section, we will present an overview of the types of technology-based SRL strategies used by EFL undergraduate students. The strategies were classified into four main types including cognitive, meta-cognitive, social behavioral, and motivational regulation strategies.

Cognitive Strategies

The participants reported using a number of cognitive strategies for English language learning in technology-using conditions. The most commonly used strategies were technology-based vocabulary learning strategies (e.g., "I use online dictionaries to check English words") and technology-based English song and movie learning strategies (e.g., "I use technologies [e.g., English movies] to learn more about English and the culture"). Table 1 shows some examples.

Table 1

Description for Cognitive Strategies

Cognitive strategies	Description
Technology-based vocabulary learning strategies	I use lexical apps to help me memorize new words. I use online dictionaries to check English words. I use technologies (e.g., vocabulary apps) to help me persist in my English learning goals.
Technology-based English song and movie learning strategies	I practice saying new expressions in English movies or programs to myself. I listen to English songs to help me remember words. I use technologies (e.g., English movies) to learn more about English and the culture. I use technologies to connect English learning with my personal interest (e.g., playing English games, or listening and singing English songs).

Previous studies found that high-achieving students reported using a wider range of cognitive strategies than low-achieving students (Effeney, Carroll, & Bahr, 2013). High achievers usually employed various adaptive strategies based on their own need, such as expending their vocabulary. Acquiring sufficient English words is a vital aspect of English language learning, which is necessary for both daily English communication and various types of English reading (Tseng et al., 2006). As argued by Carter (1998), foreign language learners need to master 1,000 word families per year in order to catch up with the level of an educated native speaker. Although it is impossible for most foreign language learners, it is nevertheless essential to persist in vocabulary learning in

order to have a good command of English.

Among the reported cognitive strategies, technology-based vocabulary leaning strategies were mentioned by almost every participant. They used the technology to assist in looking up unfamiliar English words, broadening their vocabulary, and evaluating vocabulary learning. One possible reason for a seemingly high level use of technology-based vocabulary learning strategies might be that participants in our research were under the pressure of coping with CET-4, and memorizing English vocabulary words was widely assumed to be the most important part of the test preparation effort in China.

The Meta-Cognitive Strategies

The students reported using a number of strategies emphasizing meta-cognitive regulation. Among all the reported meta-cognitive strategies, some strategies stand out: goal-setting ("At the beginning of the semester, I set technology-assisted English learning goals"), planning ("I adjust my English learning plans in response to different technology-assisted learning activities"), monitoring ("I often monitor my technology-assisted English learning progress"), and reflecting ("I reflect on the effectiveness of using technologies for English learning"). In addition, the participants also reported using self-evaluation and self-corrective strategies. Previous research findings show that metacognitive strategies like ideal planning, goal-oriented monitoring, and evaluating were significant predictors of English writing scores (Teng & Zhang, 2016). Consequently, researchers argued that EFL learners who relied on deeper processing strategies were more likely to perform better in English language learning. As Harris et al. (2011) explained, metacognitive strategies contributed to learners' cognitive maturity, which in turn had a positive influence on their academic performance. Our study, along with previous findings, is in agreement with the arguments for the vital role of metacognitive strategies in English language learning. Participants who reported using more metacognitive strategies usually get higher scores in their general English tests and CET-4.

Social Behavioral Strategies

The participants reported using a variety of social behavioral strategies in the focus group interview. The most notable trend that emerged through the data is seeking help from others through technologies, looking for opportunities for learning English through mobile apps, and interacting with English native speakers online. Such strategy is a substantial aspect of technology-based SRL (Barnard et al., 2009). Almost all the participants reported seeking help from their peers or teachers when they stuck in a problem. For instance, some participants said that "When I have problems in English learning, I ask my teacher for help through mobile phone", or "I share my problems with my classmates online so we know what we are struggling with and how to solve our problems". In addition, the students reported consulting different technological resources to seek more opportunities to learn English. For example, some students reported that "I seek opportunities to learn English online such as listening to English radios and watching English language videos". Communicating with English native speakers is also a very popular learning strategy among Chinese EFL university students.

Previous studies also identified social strategies for English language learning. Some researchers argued that Asians used more rote strategies like memorization, and they were less likely to employ communicative-type strategies like social interactive strategies (Politzer & McGroarty, 1985). However, Wharton (2000) and Su (2005) found that participants used social strategies most frequently among all the studied language-learning strategies. At strategy item levels, seeking help, which belongs to the social strategies, was found to be one of the most frequently used strategies (Anam & Stracke, 2016; Lan & Oxford, 2003). Our study also found that technology-

assisted social strategies were used frequently among students. The prevalence of information communication technology provided convenience for students to seeking resources and help from others. That might explain for the popularization of social strategies.

The Motivational Regulation Strategies

The students reported to use different types of motivational regulation strategies during focus group interviews containing: interest enhancement, performance self-talk, self-consequating, mastery self-talk, and environmental control. Interest enhancement reflected students' effort to make English learning tasks into games, or more generally to make them more enjoyable and fun to complete. For example, students said that "I try to connect the material with something I like doing or find interesting". Performance self-talk referred to students' use of subvocal statements or thoughts designed to increase their desire to complete the task by intensifying their focus on performance goals such as getting good grades. For instance, many participants said that "I remind myself about how important it is to get good grades when learning English on technology". Self-consequating measured students' reported use of self-provided extrinsic rewards for reinforcing their desire to finish academic tasks. Participants reported that they always promise themselves some kind of a reward if they get the online learning tasks done. Mastery self-talk reflected students' tendency to focus or make salient their desire to learn or master task materials in order to increase their level of motivation. Some students in the focus group interview said that "I challenge myself to complete the work online and learn as much as possible". Environmental control indicated the frequency with which students reported avoiding or reducing distractions as a means of ensuring their completion of academic tasks. For example, the participants said they tried to study at a time when they can be more focused. Otherwise, they may be attracted by other applications on the technology. The existence of motivational regulation strategies indicates that Chinese EFL undergraduates tried to associate their English language learning with their personal interests to sustain or increase their learning motivation. The use of these strategies revealed that Chinese EFL undergraduates tended to seek fun from English learning rather than simply considering it as taking a course or passing a test as other researchers discussed (e.g., Yang & Gao, 2013).

Findings on the motivational regulation strategies are in agreement with previous research that students reported using different types of motivational strategies during the process of English learning (e.g., Wolters, 1999). Moreover, findings from the research extend the study from traditional English learning context to technology-assisted English learning setting. Previous studies on motivational regulation strategies mainly conducted in traditional face-to-face language learning contexts.

Conclusion

This study explored the nature and use of technology-based self-regulated English learning strategies employed by Chinese EFL undergraduates. Framed within the social cognitive perspective of SRL, this study holds that SRL is context specific, which can be influenced by interactions among personal, behavioral, and environmental factors (Bandura, 1986). Focus group interviews were used to encourage discussion and interaction among the participants in our study. Therefore, the findings generated from this study are highly contextualized.

Overall, the findings in our study indicate that students use a range of technology-based self-regulated English learning strategies starting from shallow to wider, cognitively rich, and deep processing. Not surprisingly, students with higher English proficiency tend to use a wider range of technology-based SRL strategies. The

findings are in line with existing literature conducted in different English learning contexts such as the study conducted in Australia (Effeney et al., 2013), in online and blended learning contexts (Barnard et al., 2009), and in Chinese universities (An et al., 2021). The study further identified technology-based vocabulary learning as a dominant strategy reported by EFL undergraduate students. Almost every participant in our focus group interview mentioned that rote learning English vocabulary words through the use of lexical apps on mobile phone was a very frequently used strategy. One possible explanation for the frequent use of such strategy might be that learning English words is easier and simpler than other kinds of learning activities. Moreover, mobile apps make vocabulary learning become more convenient across time and spaces. However, as a kind of shallow learning strategy, memorizing English words may take limited effects on the improvement of English proficiency. Consequently, there is a pressing need to engage students in a variety of more meaningful vocabulary learning activities.

It is also important to be aware of the limitations of the study as we interpret the findings generated from the study. The participants in our study were mainly EFL students from one university in mainland China, which might lead to limitations of the students' English proficiency. Further research can select a wider sample from more universities in different regions.

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